Barrier Coatings and Stability of Thin Film Solar Cells

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1. OBJECTIVES/APPROACH

The key objectives of the program are to develop low cost barrier coatings for CIS and CdTe solar cells and to develop an improved understanding of the effects of water on the stability of these types of cells. The scope of this work entails investigations of multilayer, barrier coatings for CIS and CdTe thin film solar cells, and studies of stability issues, particularly those related to moisture ingress. Investigation of barrier coatings on SSI and CSU devices will continue in an effort to establish effective approaches to encapsulate CIS and CdTe modules. Studies will also be directed towards issues concerning cost of the coating process. The program will be structured into three major tasks: (1) Barrier coatings and stability studies for CIS Solar Cells; (2) Barrier coatings and stability studies for CdTe solar cells; (3) Low cost coating process development.

2. PROGRESS FOR THIS REPORTING PERIOD

Efforts have concentrated on establishing procedures for collaboration with Dr. Sampath's group at CSU and Dr. Compaan's group at the University of Toledo. In both cases, we have supplied patterned SnO_2 - coated glass for growth of CdS/CdTe structures. It turns out, however, that removing SnO_2 from LOF TEC 15 is not trivial. We received valuable guidance from Dr. Sampath. Referring to Figure 1, we plan to start with SnO_2 - coated glass, pattern the SnO_2 as illustrated in Figure 1A, send the substrates to CSU and UT for growth of CdS/CdTe devices. In the case of CSU, the back contact will be applied at PNNL for some of the structures.

Removing the tin-oxide has turned out to be non-trivial. One approach consists of bead blasting as done by CSU. We will eventually establish this capability. However, we are currently using a chemical process suggested by Dr. Sampath. This procedure involves the following steps:

1) Clean the tin oxide coated glass with acetone and TCE.

2) Apply positive photoresist to the complete surface and cure.

3) Expose photoresist with UV for 6 minutes through a mask.

4) Then the photo resist coated sample was exposed to UV light for 6 minutes through a mask.

5) A suitable developer was used to etch off the unwanted photo-resist, yielding a substrate with squares of developed photoresist.

6) Coat the complete sample with a zinc and tulene mixture by spray technique and dip into HCl for 30 minutes. The photo-resist covered area did not react to the HCl. So, the zinc coated tin oxide heavily reacted to the HCl and formed a white layer.

7) The sample was then dipped in acetone to clean photo-resist which protected the tin oxide. The resulting substrate has four square areas of SnO_2.

After developing the process for patterning tin-oxide glass, several substrates were sent to Dr. Sampath's and Dr. Copaan's groups. We are waiting for devices so that further studies of barrier coatings can be made.

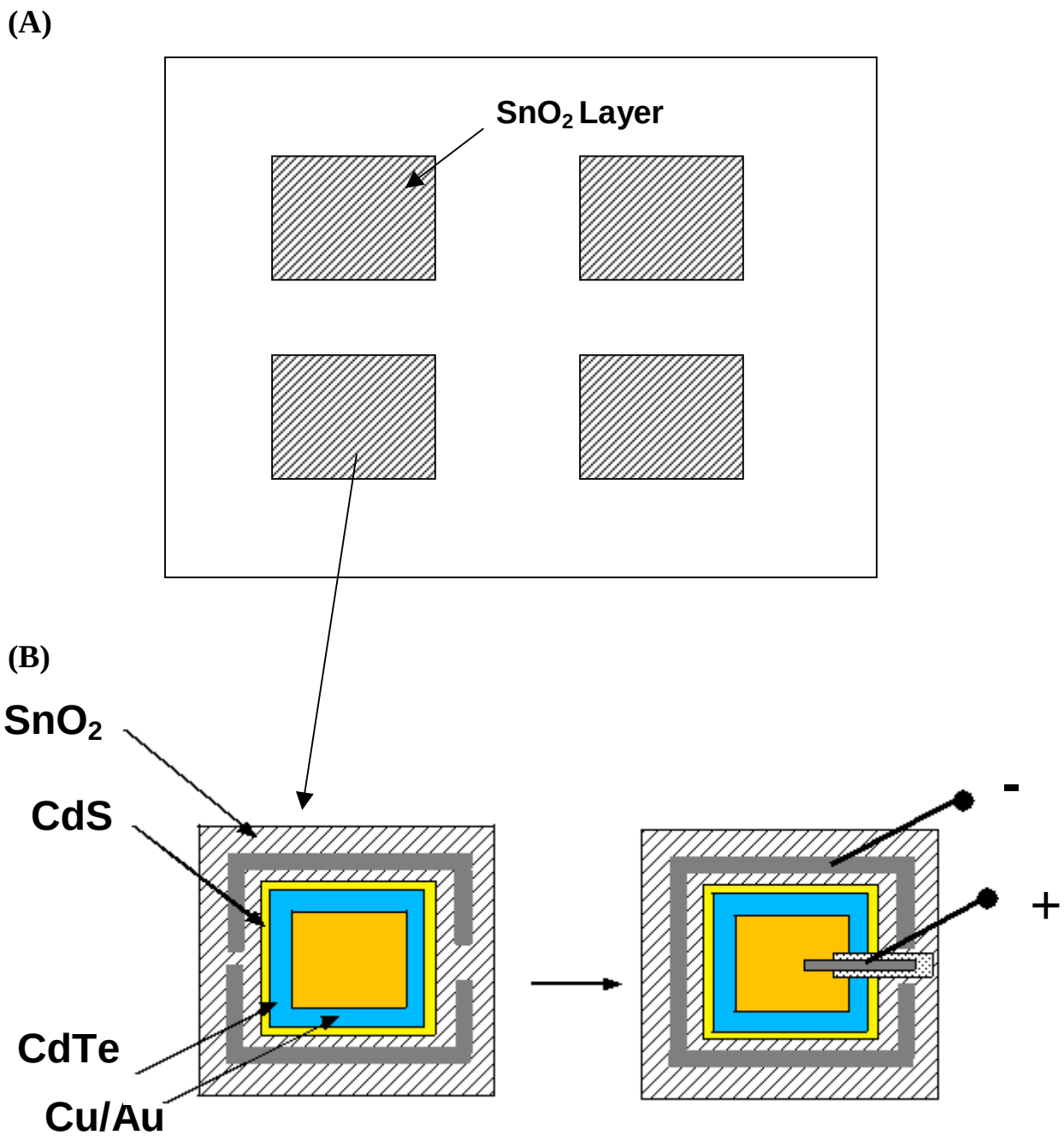

Figure 1. Illustration of approach planned for CdTe device fabrication using film structures supplied by CSU and UT. (A) Patterned SnO_2-glass; (B) Device configration for damp heat studies.